CYPHER
TECHNOLOGY LTD

PUMA

Portable **U**niversal **M**edia **A**rchive

User Manual V 2.1

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2 Description

Puma is a rugged and evidentially secure system for archiving Flash card data to CDROM/DVD media. Its automated backup procedure make it simple to use. It is aimed primarily at backing up digital cameras and Flash based audio and video recorders and includes a RAW to JPEG image converter. Puma will back up any type of file data and can be used to archive USB pen drives and other USB disk drives. The main features are as follows:

- Simple operation. Single, dedicated “Transfer” button initiates entire archive sequence. This eliminates the chance of the operator omitting part of the procedure.
- Any size of card can be archived up using multiple DVDs or CDs (new in V2.1).
- Rugged construction and no hard drive increases reliability and evidential security.
- Unique bit for bit copy of Flash card provides ultimate evidential audit trail and reduces possibility of legal challenges.
- Three automated steps in transfer procedure: Transfer, data verify, and Flash media overwrite/erase/format.
- Flash card, forensic wipe process ensures that deleted data cannot be recovered and removes any viruses.
- Fast transfer rates reduces back-up time. Up to four times faster than laptop for transferring files. 20Mbyte /sec transfer rate.
- Self contained unit with premium quality, full height DVD/CDROM R/W drive.
- Re-mounts and verifies disk after writing to ensure maximum reliability of backup.
- Supports wide range of DVD +/- R, +R/W, +R DL and CD -R media.
- Will back up USB Flash sticks.
- Proprietary software tailored precisely to the needs of law enforcement and evidence gathering. Closed nature of operating system increases evidential security
- Produces two media outputs: a Master Copy which is a bit-for-bit copy of the entire Flash memory card and a Working Copy which contains only the files from the Flash card. Where these are image files in RAW format, the system will generate JPEG versions of these files which will also be stored on the Working Copy. A list of supported RAW camera formats is given in APPENDIX 1
- Can be powered from mains, vehicle power or external batteries.
- Supports all common Flash media (see Specification).

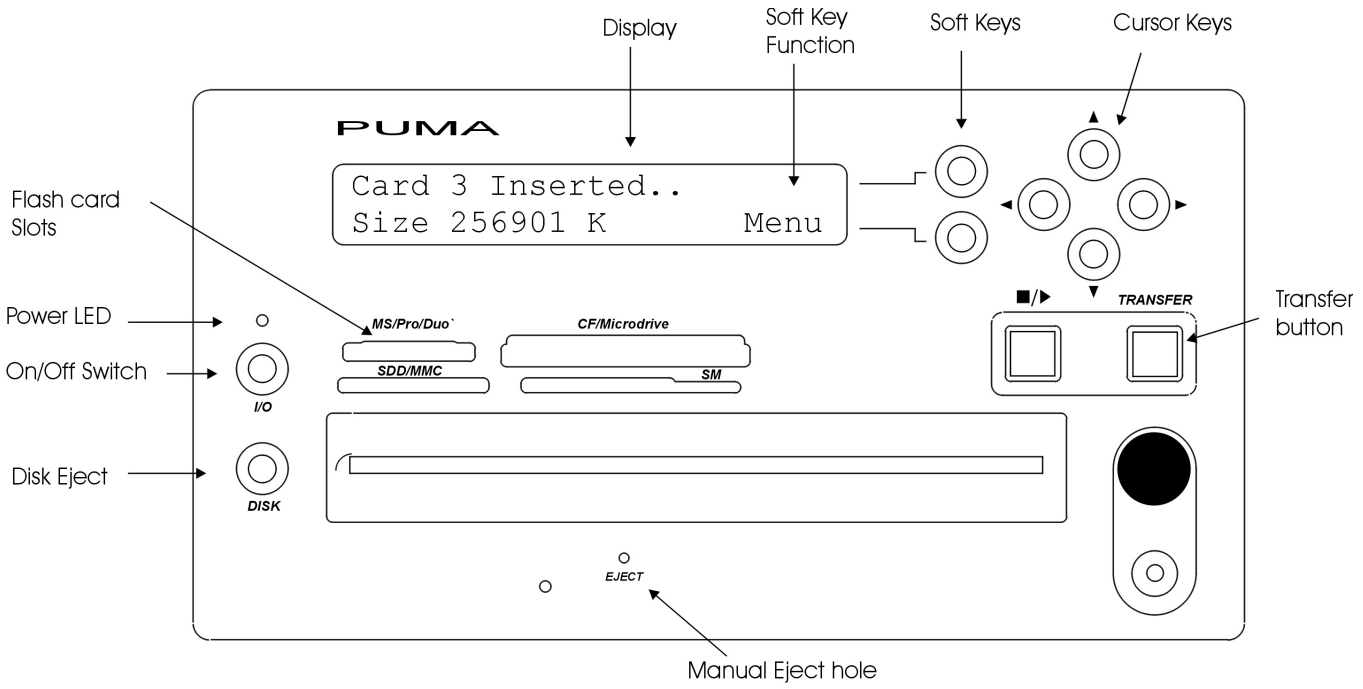

Fig 1. Front Panel

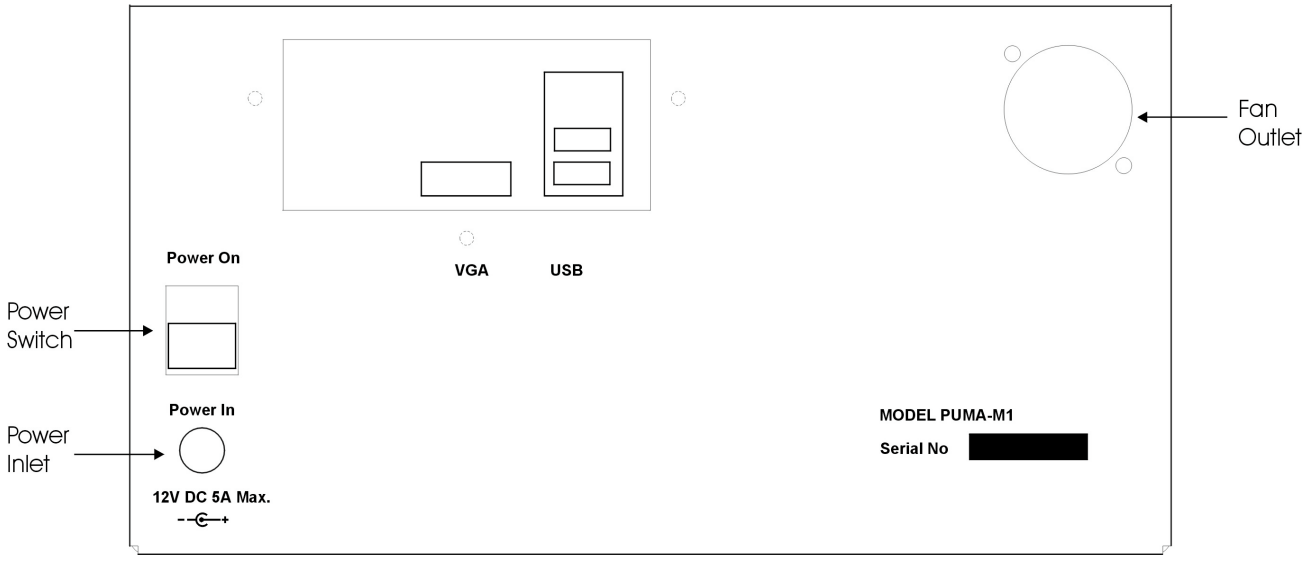

Fig 2. Rear Panel

3 Quick Start Guide

3.1 Turning On

1. Connect the supplied 12V 5A power supply (PSU) lead to rear panel power inlet and screw up the connector. Connect the PSU to a mains supply using the supplied cable.
2. Remove any Flash card.
3. Switch on the Power Switch on the rear panel (switch up). The display panel will light up and show “Press I/O”. The green front panel LED will flash.
4. Press the I/O (On/Off) switch below the green Flashing LED. “On..” will be displayed and the green LED will be on constantly.
5. After a few seconds, a growing line of dots will appear on the display and the system will be ready for use after about 20 seconds.

3.2 Transferring Flash Card Data

1. Check that the displayed time and date are correct.
2. Insert the Flash card into the appropriate front panel slot. The display will show the card’s size and number of files. A USB stick may be plugged into the rear panel.
3. Press the Disk button to open the DVD/CD draw. Place a DVD/CD in the tray and press the Disk button once more to close the tray.
4. Press the TRANSFER button to start the transfer.

   a) A Master copy is produced first. This consists of the transfer of the data from the card to the disk and a verification read of the disk image file and the card. On successful completion the Master disk will be ejected and the checksum of the Flash card will be shown. This can be noted down for future reference. (where multiple disks are produced, there are separate disk checksums also).

   b) Remove the Master Copy disk and place a new DVD on the tray. Press the lower soft key Marked “Continue” to proceed. The Working copy is now produced. On successful completion the disk will be automatically ejected.

   c) The Flash card may now be wiped and re-formatted. Press “N” when prompted if this is NOT required.

The Transfer is complete.

Note: If further copies are required, do not wipe the card, and use the appropriate functions available in the “Menu”. Press “Menu” soft key and the Up/Down cursor keys.

3.3 Turning Off

Press the I/O button below the green LED to shutdown. When “Switch Off” is displayed, turn off the rear panel Power Switch.

4 Detailed Operation

4.1 Setting up and Powering Puma

1. Connect the supplied 12V 5A power supply (PSU) lead to rear panel power inlet and screw up the connector. Connect the PSU to a mains supply using the supplied cable.
2. Remove any Flash card.
3. Switch on the Power Switch on the rear panel (switch up). The display panel will light up and show “Press I/O”. The green front panel LED will flash.
4. Press the I/O (On/Off) switch below the green Flashing LED. “On..” will be displayed and the green LED will be on constantly.
5. After a few, a growing line of dots will appear. This line will extend to the full width of the screen and then “Wait” will be displayed. A few seconds after that “Ready” will be displayed and the system is ready for use. The whole boot up procedure, from switch on, takes about 20 seconds.
6. When PUMA makes a Working Copy of RAW image files, it creates JPEG versions of these files for ease of viewing across a wide range of platforms. Where this feature is required, it must be enabled from the menu. This is done by selecting the “Enable JPEGs” function in the Menu (Section 4.13).
7. Check that the displayed time and date are correct. If not, use the “Adjust Time” menu function to adjust the time and date (Section 4.15).

4.2 Turning Off (Display Software Revision and Serial Number)

Press the I/O button below the green LED to shutdown. Press {Y} to confirm. When “Switch Off” is displayed, turn off the rear panel Power Switch.

If {N} is pressed the Software Revision and Serial Number (where appropriate) will be displayed and Puma will resume operation.

4.3 Automated Transfer Operation

1. Place the Flash card in appropriate slot. If a USB drive is to be archived, plug this into either of the USB slots in the rear panel. An extension lead may be required for bulky USB flash drives
2. Place a blank CD-R or DVD +/- R in the drive. The Master Copy is generated first. The size of the Flash card is shown on the display when it is inserted. A CD will hold 730Mbytes and a standard DVD 4,700 Mbytes. Where the flash card is larger than the disk size, multiple disks will be produced. These disks will be automatically numbered as Master Disk #1, Master Disk #2 etc. A Windows utility program is supplied, which combines the multiple disks into one master image file for ease of access. This utility program, called ImageMaker, is copied to the first disk of the set.

The Master Copy has the current time and date stamp as displayed on the front of the machine.

3. Press the Transfer button.

   (The “Cancel” soft key allows the transfer to be aborted)

   Please note: The first time a new disk type is used, there may be a delay before writing occurs as the drive calibrates itself to the disk.

Action	Display (See front panel layout)
Transfer Master begins	`Make Master Copy  05:23` `32% @ 8.4MB/S  Cancel>`
Verifying Master begins	`Verify Master  00:23` `10% @ 8.5MB/s  Cancel>`

4. Puma then ejects the verified Master Disk and displays the Checksum. This should be noted down.

   (Multiple disk transfer - If the flash card is bigger than the disk size, further disks will be requested. Each disk has its own checksum, which is displayed at the end of each disk transfer. When all the data has been transferred, no new disks will be requested. Press {Continue} and the checksum of the whole Master Image will be shown. This should be noted down. This final checksum is the same value as the checksum produced for the card.)

5.

   Puma then prompts for another blank disk to be inserted. If the process was not successful the disk will not be ejected and an error message will be displayed (the disk can be ejected manually using the [Disk] button.

Mster is ejected	`Insert Blank Disk..` `Continue>`

Press the {Continue} soft key to proceed with the Working Copy

Transfer Working begins	`dcn0004.jpg  04:34` `19% @ 8.3MB/s  Cancel>`

If the size of the files on the flash card is bigger than the disk size, further disks will be requested.

Is Flash erase required?	`Wipe Card  Y>` `N>`

Press {Y} to wipe Flash card or {N} to proceed without wiping card. After the card is wiped it is automatically partitioned and re-formatted with a FAT32 file system. If successful the display will show :

Wipe Completed	`Wipe Complete..  00:00` `Formatted  Continue>`

The Transfer process is now complete. A new Flash card may be inserted.

4.4 Menu System

When the system powers up, or after a full Transfer has completed, the display shows

```
11:32:15 Wed Nov 10 2008
Insert card...     Menu>
```

or if a card is already inserted:

```
Card Size   3.89 GB
6 Files 69.2MB     Menu>
```

Pressing the {Menu} soft key enters the Menu system.

The name of the current function is displayed on the top line of the display. The Up/down arrow keys are used to select the desired menu function. The {Exit} soft key is used to exit the Menu and return to the Top Level.

Possible operations are:

Menu Item	***Description***
`1 Make Working`	Creates Working Copy disk from Flash
`2 Make Master`	Creates Master Copy
`3 Verify Master`	Verifies card against Master Copy
`4 Restore Master`	Creates clone Flash card from Master Copy
`5 Wipe Card`	Overwrites Flash card with “0”s
`6 Checksum Card`	Calculates checksum of card
`7 Format Card`	Formats card as FAT32
`8 Checksum Disk`	Calculates checksum of Image file on Master Copy
`9 Enable JPEGs`	Allows Jpeg creation to be controlled
	Press Up/Down Arrow keys to select Yes Or No
`10 Install Software`	Install new software from DVD/CD
`11 Adjust Time`	Adjusts Puma internal time and date

4.5 Make Working Copy

This function will copy all the files from the Flash card to the CD or DVD. This is a Working Copy. It will also make JPEG copies of any RAW image files. The JPEG creation can be enabled (see “Enable JPEGs” below).

Press the {Menu} soft key to enter the Menu system. The Up/down arrow keys are used to select the desired function. Make Working Copy is at the top of the list of possible functions. If it not already displayed, press [Up Arrow] until “Make Working” is shown in the display. Insert a blank DVD or CD and press the [Go] soft key to execute the function.

On successful completion the disk is ejected. Where the total size of the files is greater than the disk size, Puma will prompt for further blank disks to be inserted as required.

Pressing the {Exit} soft key to returns to the top level.

4.6 Make Master Copy

This function will make a bit for bit copy of the whole of the Flash card to a DVD or CD. This is a Master Copy.

Press the {Menu} soft key to enter the Menu system. The Up/down arrow keys are used to select the desired function. Make Master is number 2 in the list of possible functions. If it not already displayed, press the [Up Arrow] or [Down Arrow] until “Make Master” is shown in the display. Insert a blank DVD or CD and press the [Go] soft key to execute the function. Note that the whole card is backed up (see below) and therefore if DVD or CD size is smaller than the Card size, multiple disks will be created. On successful completion the disk is ejected.

Pressing the {Exit} soft key returns to the top level.

4.7 Verify Master Copy against Flash Card

This function will check that the contents of the Master Disk are identical to the inserted Flash card.

Press the {Menu} soft key to enter the Menu system. The Up/down arrow keys are used to select the desired function. Verify Master is number 3 in the list of possible functions. If it not already displayed, press the [Up Arrow] or [Down Arrow] until “Verify Master” is shown in the display. Insert the Master DVD or CD and the Flash card in the appropriate Flash slot. Press the [Go] soft key to execute the function. When completed the checksum of the Flash card (and the disk) is displayed.

Pressing the {Exit} soft key to returns to the top level.

4.8 Restore the Master Copy to a Flash Card

This function will copy the contents of the Master Disk to the inserted Flash card. This Flash card will become a precise clone of the original card.

Press the {Menu} soft key to enter the Menu system. The Up/down arrow keys are used to select the desired function. Restore Master is number 4 in the list of possible functions. If it not already displayed, press the [Up Arrow] or [Down Arrow] until “Restore Master” is shown in the display. Insert the Master DVD or CD and a Flash card that is the same size or bigger than the original. Press the [Go] soft key to execute the function. When completed the checksum of the Flash card (and the disk) is displayed. This card is functionally identical to the original. It may be inserted back into the camera or may be read on a computer and the images viewed or the files accessed.

Pressing the {Exit} soft key to returns to the top level.

4.9 Wipe Flash Card

This function will perform a forensic wipe of the Flash card. No data will be recoverable from the card after this operation (see below).

Press the {Menu} soft key to enter the Menu system. The Up/down arrow keys are used to select the desired function. Wipe Card is number 5 in the list of possible functions. If it not already displayed, press [Up Arrow] or [Down Arrow] until "Wipe Card" is shown in the display. Press the {Go} soft key to execute the function. This function writes "0"s to the card. After the card is wiped, it is formatted as FAT32 and is ready for use. Pressing the {Exit} soft key to returns to the top level.

4.10 Calculate the Checksum of the Flash Card

This function will generate a unique number from the contents of the Flash card. This is called a checksum (see below). This number provides a useful and secure identification for the card and the Master Copy. The checksum of the card will be the same as the checksum of the Master image file for that card.

Press the {Menu} soft key to enter the Menu system. The Up/down arrow keys are used to select the desired function. Checksum Card is number 6 in the list of possible functions. If it not already displayed, press [Up Arrow] or [Down Arrow] until "Checksum Card" is shown in the display. Press the {Go} soft key to execute the function. When the process is complete, the checksum is displayed.

Pressing the {Exit} soft key to returns to the top level.

4.11 Format Flash card

This function first overwrites the Master Boot Record of the card with binary "0"s thereby removing any boot sector viruses. It then re-partitions the card with a single primary partition of the maximum size and then formats this with a FAT32 file system. Note this function does not wipe the data area of the card. The Wipe card function must be used if this is required. See Section 4.9.

Press the {Menu} soft key to enter the Menu system. The Up/down arrow keys are used to select the desired function. Checksum Master is number 7 in the list of possible functions. If it not already displayed, press [Up Arrow] or [Down Arrow] until "Format Card" is shown in the display. Press the {Go} soft key to execute the function. When complete "Formatted" is displayed.

Pressing the {Exit} soft key to returns to the top level.

4.12 Calculate the Checksum of the Master Disk Image

This function will generate a unique number from the contents of the Master Copy disk. This is called a checksum (see below). This number provides a useful and secure identification for the Master Copy and the Flash card.

Press the {Menu} soft key to enter the Menu system. The Up/down arrow keys are used to select the desired function. Checksum Master is number 8 in the list of possible functions. If it not already displayed, press [Up Arrow] or [Down Arrow] until "Checksum Master" is shown in the display. Press the {Go} soft key to execute the function. When complete the checksum is displayed.

Pressing the {Exit} soft key to returns to the top level.

4.13 Enable JPEG creation on Working Copies

This function will turn on the automatic creation of JPEG files on Working Copy disks. This will slow down the creation of the Working Copy where RAW image files are present.

Press the {Menu} soft key to enter the Menu system. The Up/down arrow keys are used to select the desired function. Enable JPEGs is number 9 in the list of possible functions. If it not already displayed, press [Up Arrow] or [Down Arrow] until “Enable JPEGs” is shown in the display. Press the {Go} soft key to execute the function. Press the {Change} soft key to toggle between enabling JPEG creation or disabling JPEG creation.

Press the {Exit} soft key to return to the Menu and press {Exit} once more to return to the Top Level.

4.14 Software Installation Procedure

This function installs new versions of the operating software. It is accessed from the Menu as function 10. The procedure from a “cold” start is as follows:

1. Boot up Puma.

2. Press the {Menu} soft key to enter the menu.

3. Press the [Down Arrow] key until “10 Install Software” appears.

Either:

Press the [Disk] button to eject tray.

Place an upgrade disk on the tray and press [Disk] button once more to load the disk. The disk will take a few seconds to be recognised. Please wait.

Or:

Plug in a USB drive to the rear panel of the Puma. This should have the install file and the data files copied to the root directory of the drive as described in the download instructions.

5. Press the {Go} soft key to start the software upgrade. The installation progress will be shown on the screen. DO NOT SWITCH OFF DURING THIS PROCESS OR THE SYSTEM MAY BE UNUSABLE.

6. When complete the system will display “Installation complete” or it will restart the new version of the program.

7. Switch off and reboot.

8. Check the Version number (displayed at boot up) is the same as that labelled on the Install CD or DVD.

4.15 Adjust the Internal Time and Date

This function allows the internal real-time clock to be adjusted. This clock is used to time and date stamp the flash.img file on the Master disk.

Press the {Menu} soft key to enter the Menu system. The Up/down arrow keys are used to select the desired function. Adjust time is number 11 in the list of possible functions. If it not already displayed, press [Down Arrow] until "`Adjust Time`" is shown in the display. Press the {`Go`} soft key to execute the function. The time and date is displayed in the top line of the display. E.g.

Adjust Time display

```
15:03:21 Tue Jan  9 2007
Sel <> Adj Up Dn   Exit>
```

The hours number will flash and the [Up] and [Down] cursor keys can be used to adjust the value. The [<] and [>] cursor keys can be used to select other fields. When the correct time and date has been displayed, press the {Exit} soft key to exit back to the Menu list.

Pressing the {Exit} soft key once more returns to the top level.

4.16 How is the Master Copy used?

4.16.1 Master Copy – The ultimate evidential exhibit

The Master Copy contains a single file called "flash.img" which is a bit for bit copy of the whole of the Flash card. This includes the files, deleted files, the file system, partition information and all historical file data. As such it provides the most secure, evidential backup and allows the most complete evidential audit trail. It contains everything that was on the Flash card and is the same size (in Kbytes) as the Flash card. The flash.img file has its time created, modified and accessed values set to the time of the start of the transfer. This time is taken from the system time as displayed on the front panel of the machine at start-up.

When the flash card is bigger than the disk size, multiple disks are needed and each disk will contain part of the image. The first disk will contain a file called flash1.img , the second disk, flash2.img etc. These part images may be combined to form a single, complete image file (see Section 4.18).

The Master Copy can be used in two ways. On a PC with an Image Viewer program or by restoring the image back to a Flash card or USB disk.

4.17 Accessing the Master Copy with WinImage

Firstly, the flash.img file on the Master Copy disk can be opened with a disk image viewer program. Such a program is WinImage, a trial version of which may be downloaded from: http://www.winimage.com/download.htm

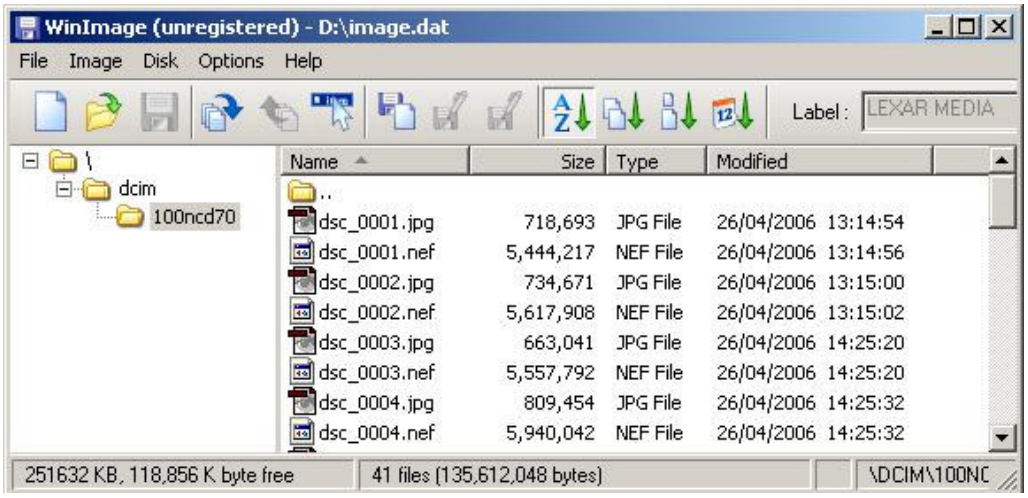

Fig 3. Winimage screen display under Windows XP

The viewer programs allow the user to open the flash.img file as if they were opening a disk in Windows explorer. Individual directories can be viewed and opened and their files accessed or copied.

4.18 ImageMaker – Combining Multiple Disk Images

If the Master is split across several disks, the ImageMaker utility, on Master Disk #1 must be run to combine the images on the different Master Disks into one file. To run ImageMaker, place Master Disk #1 in the PC drive. Double click on the ImageMaker icon and run the program.

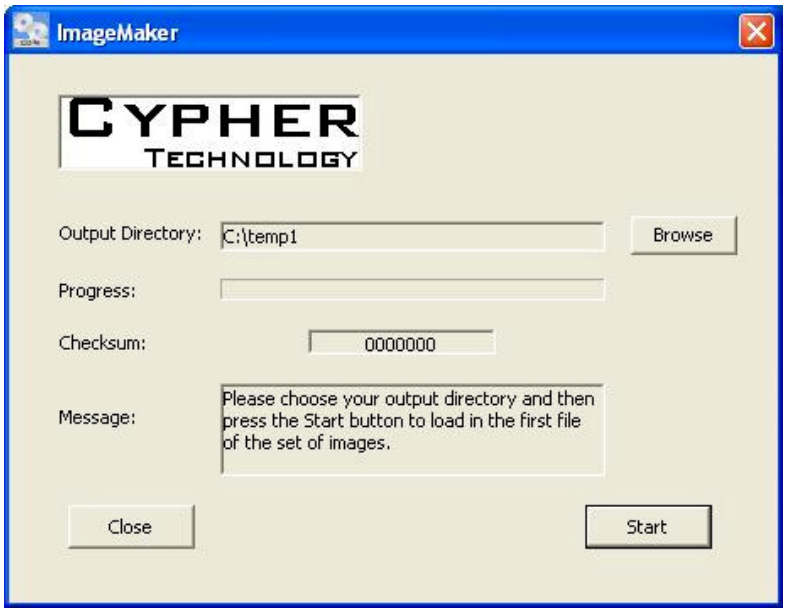

Fig 4. ImageMaker screen display under Windows XP

Select the destination folder with the Browse tab and then click {Start} to start conversion. When the first disk is complete, then load disk #2. Follow the on screen instructions until all disks have been transferred. After each disk is completed the

following dialogue box is shown. After the last disk, press the {Finish} button to close the image file.

ImageMaker
File [flash2.img] has been copied succesfully.
Please insert the disc for the third file and then press OK.
Press Finish if there are no more discs.
OK
Finish

Fig 5. ImageMaker dialogue

The name of the new, combined image file is shown in the message window and is generated from the original image file name and the current date and time.

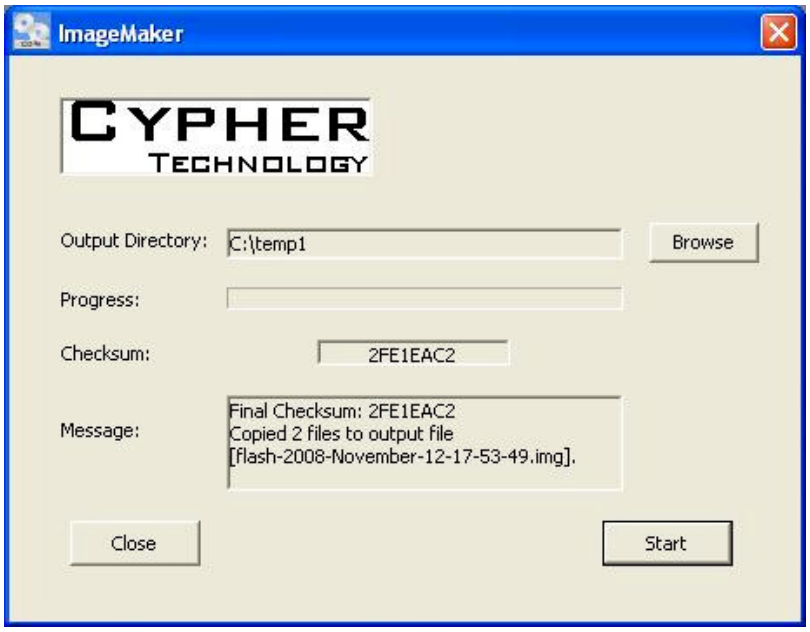

Fig 6. ImageMaker final screen

The Checksum shown at the end should be the same as the checksum noted down during the making of the Master. Restore the Master Image to a Flash Card

This single .img file can be accessed by WinImage in the normal way.

Restore the Image Back to a Card

Secondly, the disk image can be copied back to a flash card of equal or greater size than the flash.img file (and therefore the original Flash card). This copied flash card will behave as an exact clone of the original allowing, for example, the un-erasing of files and the forensic examination of file allocation addresses and access dates. On Puma this task is performed by the Restore Master function (see Section 4.8).

5 Technical Background

5.1 Master Copy (bit for bit copy)

The Master Copy contains a single file called “flash.img” which is a bit for bit copy of the whole of the Flash card. Because the whole of the card is copied, the Master includes hidden files, deleted files, historical file data fragments, original time-accessed and time-modified data, the filing system (FAT), and the boot sector and partition information.

As such it provides the most secure, evidential backup and allows the most complete evidential audit trail. It contains everything that was on the Flash card and is the same size (in Kbytes) as the Flash card.

Simple card copiers only copy the undeleted, non-hidden files. This leaves the exhibit open to legal challenge.

5.1.1 Why archive the file system?

First some technical background on how files (such as pictures in a digital camera) are stored on a Flash card.

A file is a digital container for digital data. As an example, one digital still image is normally stored in one file. The file has a name and this is how it is referenced and accessed (e.g. DSC_0001.JPG).

A filing system on a disk or Flash card is used to show where all data in the files is located on that disk or Flash card.

A filing system (such as the FAT16 or FAT32 system) consists of two parts: a file allocation table and the file data itself.

5.1.2 Partition Table

Sometimes it is useful to divide one physical disk (e.g. a hard disk) into multiple drives (c: drive, e: drive etc.). A partition table describes how the drive is divided into different virtual disks. Flash cards and USB pen drives consist normally of one partition, but still normally contain a partition table. Strictly speaking they don’t need a partition table and some flash cards don’t have one. Also, Windows XP will format a wiped, blank flash card with no partition table.

The partition table is not updated after it is created but the way the partition table is written will vary from system to system and thus can give some knowledge of the history of the card.

5.1.3 File Allocation Information

Most Flash media cards use the FAT16 or FAT32 file system. When a file (e.g. a JPEG picture file in a camera) is created, two things happen. Firstly the file data is written to the data area of the card and secondly the file allocation table is updated. The file allocation table contains such information as the file name, the file creation/modification times and dates and of course where the file data lives on the card.

5.1.4 File un-deletion

When a file is deleted the actual file data is normally left unchanged on the storage device. The deletion involves marking the file name in the file table to show that the file is no longer required and that the data space that was being used on the card can be used for new files. Because of this, if no further data is written to the card, the original deleted file may be retrieved or "un-deleted". The Master Copy allows for un-deletion of files where it was possible on the Flash card. (See "How is the Master Copy used?" above). The Working Copy, of course, will not contain deleted files.

5.1.5 Historical file data

When a file is copied from the Flash card to another storage device (as with the Working Copy) information about its creation may be lost. Most obviously this may include the original modification and creation times from the Flash file table but also more subtle historical information may be lost relating to the media history.

5.1.6 Media History

When a file is created on a blank piece of media, the storage space is generally allocated from the beginning of the data area. Once several files have been created and then a few have been deleted "holes" appear on the file data area where the old file data resided. These holes will eventually be overwritten with new file data as new files are created, but because these new files may be of different sizes to the old files, one new file may have its data spread across the disk at various locations. The more a Flash card or drive is used, the more fragmented it becomes. This gives valuable information about the use of the media and the time of creation or modification of a file.

The Master Copy preserves all this information as it provides an exact snapshot of the state of the card when the copy is taken and because it leaves all the card data unchanged within the backup. The Master Copy is therefore the most important evidential backup.

5.2 Disk Verify Read

Most backup programs simply copy the data to the backup medium and assume it has been written correctly and can be re-read. With optical disks this is particularly dangerous. PUMA dramatically reduces the chance of producing unreadable disks by performing a verify read of the disk after it has been written. The verify pass itself, involves re-reading every data bit from the Flash card and checking it against every bit in the flash.img file.

5.3 Working Copy (file copy)

The Working Copy is a full copy of the directory tree of the Flash card or USB drive. This means all files and directories are copied. Any file types can be copied. It provides a function similar to conventional backup software.

For the files on the Flash card to be recognised by PUMA, the card must be formatted with a FAT16 or FAT32 file system. The Working Copy disk uses an ISO9660 filing system and is recognised by most computing platforms. The system also implements the Joliet extension to the ISO 9660 standard which allows for long file names.

Where RAW image files are detected, the system automatically converts them to a JPEG compressed image file with a compression ratio of about 7:1. The file has the same root name as the original, so that dcn0005.nef becomes dcn0005nef.jpg. For most picture content it will not be possible to readily observe any difference in quality between the JPEG and RAW images. Where this feature is not required, it may be disabled (see above).

A wide range of RAW file formats are supported and these are listed in the Appendix.

5.4 Card and Disk Checksum

Puma produces a 32 bit checksum of the Flash card and Master Copy file. The checksum is a unique number derived from all the data on the card or from the whole image file on the Master Copy. As such the checksum will always change if any data changes are made within the file or on the card. The chance of two Flash cards, with different image data, of having the same checksum is 1 in 4,000,000,000.

The checksum of a Flash card or Master Copy can be found using the Menu functions (see above).

5.5 Flash Card Wipe (Erasing)

As mentioned above, when a file is deleted the file data remains on the medium. This file may be un-deleted and the file's data recovered. The only way to render the card safe from data recovery is to re-write the whole card with new data. Puma "Wipe Card" function writes binary zeros to the whole card. Also viruses may be present in the Master Boot Record (MBR). During the wipe process the MBR is overwritten also and is recreated during the format operation.

5.6 System Architecture

Puma is based on a Linux platform and uses proprietary software. The proprietary nature of the software has allowed the transfer process to be tailored precisely to the needs of law enforcement and evidence gathering. For maximum reliability and security it contains no hard disk and boots from a read-only Flash file system.

5.7 Transfer Times

The Media Transfer Station uses a full height, high performance CD/DVD writer drive. This type of drive provides transfer rates up to 20 Mbyte/sec compared with 8Mbyte/sec for laptop drives. Also, the larger size of the drive provides a higher reliability disk.

Further time is saved during the transfer as the separate tasks (Transfer, Verify and Erase) are started automatically, one after the other. The user does not have to open separate applications for disk imaging, file copy, file verify, raw file conversion and Flash erase. Clearly for the user to run these five programs manually in sequence would require considerable time and perhaps more important, be prone to error. A single, automated process avoids these sources of error and saves time.

For reading, the maximum transfer rate (at he outside of the disk) is about 20 Mbytes/sec. A 4 Gbyte card can be copied in about 4 minutes.

Master Creation

When making the Master disk, the whole contents of the Flash card are coped to the CD/DVD. The transfer time is dependent on the Flash card size. A 4GByte card would take about 5 minutes to transfer.

Master Verify

This involves re-reading the Flash card and comparing the data with the disk image. This takes about 4 minutes for a 4 Gbyte card.

Working Copy Creation

This involves only copying the files themselves and the time taken will depend on the amount of data contained in the files. A large RAW file of say 16 Mbytes would take around 1 second to transfer.

Where a JPEG is created from the RAW file this will take from a few seconds to a few tens of seconds per file depending on the size of the RAW file.

Flash Erasure

The erasing process involves writing a fixed binary pattern of data back to the Flash media so that the original data cannot be recovered or un-erased under any circumstances. This wiping process therefore depends on the write speed of the particular Flash card. Write speeds are commonly up to about 10 Mbytes/s which gives an erase time of about 6 minutes for a 4 Gbyte card.

Transfer Time for a Complete Automated Master and Working Copy

Example:

For a 4 Gbyte SD card with 6 x 16 Mbytes RAW files the transfer time would be:

Create Master	5 Mins
Master Verify	4 Mins
Create Working Copy	3 Mins (depends of RAW conversion speed)
Erase Flash	6 Mins(Depends of Flash card type and brand)
Total	18 Minutes

5.8 RAW File handling

RAW to JPEG converter

The system incorporates a RAW image file format converter. This automatically detects the type of RAW file present and converts it to a standard JPEG image file which is added to the Working Copy along with the original RAW format file. The JPEG will typically be about $1/7^{th}$ the size of the RAW file, and so will not add greatly to storage requirements. This software is maintained and new formats are supported as they arise.

The JPEG file will have the same root name as the RAW file. For example, if the RAW image file is D94L0948.DCR the JPEG will be D94L0948DCR.JPG

The cameras currently supported by the converter are listed in Appendix 1.

6 Technical Support

6.1 System re-starting in the event of failure

Every effort has been made to allow PUMA cope gracefully with various fault conditions. It is possible, however, that the system will temporally lock-out. If the system does not respond during use (please wait for 3 minutes during a transfer), then the system should be powered down by switching off at the rear panel. Remove the Flash card and re-start the system. The disk can only be ejected once the system is ready for use. In an emergency, when the system cannot be powered, the disk can be ejected by pushing hard with a blunt rod through the disk eject hole in the front panel.

6.2 Contact

In case any technical or user assistance is required please contact Griffiths Communications on:

+01547 560112

or email:

support@griffcomm.co.uk

Address:

Griffiths Communications,

Unit 31, Ddole Road Enterprise Park

Llandrindod Wells,

Powys,

LD1 6DF

or

Cypher Technology Limited,

5-7 Gravel Hill,

Leatherhead,

Surrey,

KT22 7HG

6.3 Software Updates

The system can be updated with new application software when necessary. This software can be installed from CD or from a USB thumb drive. See Section 4.14. Updates can be downloaded from:

:

http://www.cyphertechnology.co.uk/

7 Specifications

Power	12 +- 0.4V dc 5A (max.) 1.5 A Idle.
Polarity	Centre pin +ve
Supplied PSU	100-240Vac 1.5A 47-63 Hz
Card Types	Memory Stick, Memory Stick PRO, Microdrive, MultiMediaCard, SD Memory Card, SmartMedia Card, Memory Stick Duo, Memory Stick PRO Duo, CompactFlash Card, USB memory stick
Card Size	Any Size
Disk Types	DVD +/-R, +RW, CD –R
Transfer rate	DVD +R/-R up to 20 Mbyte/sec
Software	Proprietary Linux. Solid state Flash read only
Start-up time	M1: 45 secs M1.1 32 secs
Size:	190w x 100h x 202d mm
Weight	1.92Kg

8 Disclaimer

Although every effort is made to ensure that the information contained in this manual is accurate, Cypher Technology Limited cannot be held responsible for any errors or omissions.

Cypher Technology Limited cannot be held responsible or liable for any loss either direct or indirect which results from use of the equipment described in this manual.

9 Appendix 1

9.1 Supported Camera Types

The system includes a RAW file converter for generating JPEGs for the Working Copy. This is the current list of supported cameras and file formats for the converter. **Note all camera types are supported for file transfer, not just those below.**

- Adobe Digital Negative (DNG)
- Apple QuickTake 100
- Apple QuickTake 150
- Apple QuickTake 200
- AVT F-080C
- AVT F-145C
- AVT F-201C
- AVT F-510C
- AVT F-810C
- Canon PowerShot 600
- Canon PowerShot A5
- Canon PowerShot A5 Zoom
- Canon PowerShot A50
- Canon PowerShot A460
- Canon PowerShot A530
- Canon PowerShot A610
- Canon PowerShot A620
- Canon PowerShot A630
- Canon PowerShot A640
- Canon PowerShot A650
- Canon PowerShot A710 IS
- Canon PowerShot A720 IS
- Canon PowerShot Pro70
- Canon PowerShot Pro90 IS
- Canon PowerShot G1
- Canon PowerShot G2
- Canon PowerShot G3
- Canon PowerShot G5
- Canon PowerShot G6
- Canon PowerShot G7
- Canon PowerShot G9
- Canon PowerShot S2 IS
- Canon PowerShot S3 IS
- Canon PowerShot S5 IS
- Canon PowerShot SD300
- Canon PowerShot S30
- Canon PowerShot S40
- Canon PowerShot S45
- Canon PowerShot S50
- Canon PowerShot S60
- Canon PowerShot S70
- Canon PowerShot Pro1
- Canon EOS D30
- Canon EOS D60
- Canon EOS 5D
- Canon EOS 10D
- Canon EOS 20D
- Canon EOS 30D
- Canon EOS 40D
- Canon EOS 50D
- Canon EOS 300D
- Canon EOS 350D
- Canon EOS 400D

- Canon EOS 450D
- Canon EOS 1000D
- Canon EOS D2000C
- Canon EOS-1D
- Canon EOS-1DS
- Canon EOS-1D Mark II
- Canon EOS-1D Mark III
- Canon EOS-1D Mark II N
- Canon EOS-1Ds Mark II
- Canon EOS-1Ds Mark III
- Casio QV-2000UX
- Casio QV-3000EX
- Casio QV-3500EX
- Casio QV-4000
- Casio QV-5700
- Casio QV-R41
- Casio QV-R51
- Casio QV-R61
- Casio EX-S100
- Casio EX-Z4
- Casio EX-Z50
- Casio EX-Z55
- Casio Exlim Pro 505
- Casio Exlim Pro 600
- Casio Exlim Pro 700
- Contax N Digital
- Creative PC-CAM 600
- Epson R-D1
- Foculus 531C
- Fuji FinePix E550
- Fuji FinePix E900
- Fuji FinePix F700
- Fuji FinePix F710
- Fuji FinePix F800
- Fuji FinePix F810
- Fuji FinePix S2Pro
- Fuji FinePix S3Pro
- Fuji FinePix S5Pro
- Fuji FinePix S20Pro
- Fuji FinePix S100FS
- Fuji FinePix S5000
- Fuji FinePix S5100/S5500
- Fuji FinePix S5200/S5600
- Fuji FinePix S6000fd
- Fuji FinePix S7000
- Fuji FinePix S9000/S9500
- Fuji FinePix S9100/S9600
- Fuji IS-1
- Hasselblad CFV
- Hasselblad H3D
- Imacon Ixpress 16-megapixel
- Imacon Ixpress 22-megapixel
- Imacon Ixpress 39-megapixel
- ISG 2020x1520
- Kodak DC20
- Kodak DC25
- Kodak DC40
- Kodak DC50
- Kodak DC120
- Kodak DCS200
- Kodak DCS315C
- Kodak DCS330C
- Kodak DCS420
- Kodak DCS460
- Kodak DCS460A
- Kodak DCS520C
- Kodak DCS560C
- Kodak DCS620C
- Kodak DCS620X
- Kodak DCS660C

- Kodak DCS660M
- Kodak DCS720X
- Kodak DCS760C
- Kodak DCS760M
- Kodak EOSDCS1
- Kodak EOSDCS3B
- Kodak NC2000F
- Kodak ProBack
- Kodak PB645C
- Kodak PB645H
- Kodak PB645M
- Kodak DCS Pro 14n
- Kodak DCS Pro 14nx
- Kodak DCS Pro SLR/c
- Kodak DCS Pro SLR/n
- Kodak C330
- Kodak C603
- Kodak P850
- Kodak P880
- Kodak KAI-0340
- Konica KD-400Z
- Konica KD-510Z
- Leaf Aptus 17
- Leaf Aptus 22
- Leaf Aptus 54S
- Leaf Aptus 65
- Leaf Aptus 75
- Leaf Aptus 75S
- Leaf Cantare
- Leaf CatchLight
- Leaf CMost
- Leaf DCB2
- Leaf Valeo 6
- Leaf Valeo 11
- Leaf Valeo 17
- Leaf Valeo 22
- Leaf Volare
- Leica Digilux 2
- Leica Digilux 3
- Leica D-LUX2
- Leica D-LUX3
- Leica V-LUX1
- Logitech Fotoman Pixtura
- Mamiya ZD
- Micron 2010
- Minolta RD175
- Minolta DiMAGE 5
- Minolta DiMAGE 7
- Minolta DiMAGE 7i
- Minolta DiMAGE 7Hi
- Minolta DiMAGE A1
- Minolta DiMAGE A2
- Minolta DiMAGE A200
- Minolta DiMAGE G400
- Minolta DiMAGE G500
- Minolta DiMAGE G530
- Minolta DiMAGE G600
- Minolta DiMAGE Z2
- Minolta Alpha/Dynax/Maxxum 5D
- Minolta Alpha/Dynax/Maxxum 7D
- Nikon D1
- Nikon D1H
- Nikon D1X
- Nikon D2H
- Nikon D2Hs
- Nikon D2X
- Nikon D2Xs
- Nikon D3
- Nikon D40
- Nikon D40X

- Nikon D50
- Nikon D60
- Nikon D70
- Nikon D70s
- Nikon D80
- Nikon D90
- Nikon D100
- Nikon D200
- Nikon D300
- Nikon D700
- Nikon E700
- Nikon E800
- Nikon E880
- Nikon E900
- Nikon E950
- Nikon E990
- Nikon E995
- Nikon E2100
- Nikon E2500
- Nikon E3200
- Nikon E3700
- Nikon E4300
- Nikon E4500
- Nikon E5000
- Nikon E5400
- Nikon E5700
- Nikon E8400
- Nikon E8700
- Nikon E8800
- Nikon Coolpix P6000
- Nikon Coolpix S6
- Nokia N95
- Olympus C3030Z
- Olympus C5050Z
- Olympus C5060WZ
- Olympus C7070WZ
- Olympus C70Z,C7000Z
- Olympus C740UZ
- Olympus C770UZ
- Olympus C8080WZ
- Olympus E-1
- Olympus E-3
- Olympus E-10
- Olympus E-20
- Olympus E-300
- Olympus E-330
- Olympus E-400
- Olympus E-410
- Olympus E-420
- Olympus E-500
- Olympus E-510
- Olympus E-520
- Olympus SP310
- Olympus SP320
- Olympus SP350
- Olympus SP500UZ
- Olympus SP510UZ
- Olympus SP550UZ
- Olympus SP560UZ
- Panasonic DMC-FZ8
- Panasonic DMC-FZ18
- Panasonic DMC-FZ28
- Panasonic DMC-FZ30
- Panasonic DMC-FZ50
- Panasonic DMC-L1
- Panasonic DMC-L10
- Panasonic DMC-LC1
- Panasonic DMC-LX1
- Panasonic DMC-LX2
- Panasonic DMC-LX3

- Pentax *ist D
- Pentax *ist DL
- Pentax *ist DL2
- Pentax *ist DS
- Pentax *ist DS2
- Pentax K10D
- Pentax K20D
- Pentax K100D
- Pentax K100D Super
- Pentax K200D
- Pentax Optio S
- Pentax Optio S4
- Pentax Optio 33WR
- Pentax Optio 750Z
- Phase One LightPhase
- Phase One H 10
- Phase One H 20
- Phase One H 25
- Phase One P 20
- Phase One P 25
- Phase One P 30
- Phase One P 45
- Pixelink A782
- Polaroid x530
- Rollei d530flex
- RoverShot 3320af
- Samsung GX-1S
- Samsung GX-10
- Sarnoff 4096x5440
- Sigma SD9
- Sigma SD10
- Sigma SD14
- Sinar 3072x2048
- Sinar 4080x4080
- Sinar 4080x5440
- Sinar STI format
- SMaL Ultra-Pocket 3
- SMaL Ultra-Pocket 4
- SMaL Ultra-Pocket 5
- Sony DSC-F828
- Sony DSC-R1
- Sony DSC-V3
- Sony DSLR-A100
- Sony DSLR-A200
- Sony DSLR-A300
- Sony DSLR-A350
- Sony DSLR-A700
- Sony DSLR-A900
- Sony XCD-SX910CR
- STV680 VGA